EXHIBIT A

August 31, 2001

Curriculum Vitae – Fred Russell Kramer

Personal

Birth	July 7, 1942 – New York City
Family	Married – two children

Education

1956 - 1959	The Bronx High School of Science
1959 - 1964	University of Michigan – B.S. with Honors in Zoology
1964 - 1969	The Rockefeller University – Ph.D. (with Vincent Allfrey)
1969 - 1972	Columbia University – Postdoctoral training (with Sol Spiegelman)

Experience

1962 - 1964	Laboratory Technician, Cytogenetics Laboratory Carnegie Institution of Washington, Ann Arbor, Michigan
1969 - 1986	Department of Genetics and Development and Institute of Cancer Research College of Physicians and Surgeons Columbia University

1969 - 1971	Fellow of the American Cancer Society
1971 - 1972	Research Associate
1972 - 1973	Instructor
1973 - 1980	Assistant Professor
1980 - 1983	Senior Research Associate
1983 - 1986	Research Scientist

1986 - present	Member and Chairman, Department of Molecular Genetics The Public Health Research Institute
1987 - present	Research Professor of Microbiology and Cell Biology New York University School of Medicine

Professional activities

Member of the Corporation, Bermuda Biological Station
American Association of University Professors
New York Academy of Sciences
American Society for Biochemistry and Molecular Biology
American Society of Microbiology
The RNA Society
Society of the Sigma Xi
President, Kramer Consulting, Inc.

Bibliography

Structure and function of lampbrush chromosomes

1. Kramer FR (1964) The kinetics of deoxyribonuclease action on the lampbrush chromosomes of *Triturus*. Undergraduate honors thesis. University of Michigan. Thesis advisors: Berwind P. Kaufmann and Helen Gay.

2. Davidson EH, Crippa M, Kramer FR, and Mirsky AE (1966) Genomic function during the lampbrush chromosome stage of amphibian oogenesis. Proc Natl Acad Sci USA 56, 856-863.

Translation of messenger RNA

3. Kramer FR (1969) Factors affecting translation of messenger RNAs *in vitro*: use of a GTP analog to investigate rates of polypeptide chain elongation. Doctoral dissertation. The Rockefeller University. Thesis advisor: Vincent Allfrey.

Sequence and structure of replicating RNAs

4. Kacian DL, Mills DR, Kramer FR, and Spiegelman S (1972) A replicating RNA molecule suitable for a detailed analysis of extracellular evolution and replication. Proc Natl Acad Sci USA 69, 3039-3042.

5. Mills DR, Kramer FR, and Spiegelman S (1973) Complete nucleotide sequence of a replicating RNA molecule. Science 180, 916-927.

6. Mills DR, Kramer FR, Dobkin C, Nishihara T, and Spiegelman S (1975) Nucleotide sequence of microvariant RNA: another small replicating molecule. Proc Natl Acad Sci USA 72, 4252-4256.

7. Klotz G, Kramer FR, and Kleinschmidt AK (1980) Conformational details of partially base-paired small RNAs in the nanometer range. Electron Microscopy 2, 530-531.

In vitro evolution of replicating RNAs

8. Kramer FR, Mills DR, Cole PE, Nishihara T, and Spiegelman S (1974) Evolution *in vitro*: sequence and phenotype of a mutant RNA resistant to ethidium bromide. J Mol Biol 89, 719-736.

Sequence analysis by chain termination

9. Kramer FR and Mills DR (1978) RNA sequencing with radioactive chain-terminating ribonucleotides. Proc Natl Acad Sci USA 75, 5334-5338.

10. Mills DR and Kramer FR (1979) Structure-independent sequence analysis. Proc Natl Acad Sci USA 76, 2232-2235.

11. Axelrod VD and Kramer FR (1985) Transcription from bacteriophage T7 and SP6 RNA polymerase promoters in the presence of 3'-deoxyribonucleoside 5'-triphosphate chain terminators. Biochemistry 24, 5716-5723.

Mechanism of RNA replication

12. Mills DR, Dobkin C, and Kramer FR (1978) Template-determined, variable rate of RNA chain elongation. Cell 15, 541-550.

13. Dobkin C, Mills DR, Kramer FR, and Spiegelman S (1979) RNA replication: required intermediates and the dissociation of template, product, and Qβ replicase. Biochemistry 18, 2038-2044.

14. Mills DR, Kramer FR, Dobkin C, Nishihara T, and Cole PE (1980) Modification of cytidines in a Qβ replicase template: analysis of conformation and localization of lethal nucleotide substitutions. Biochemistry 19, 228-236.

15. Kramer FR and Mills DR (1981) Secondary structure formation during RNA synthesis. Nucleic Acids Res 9, 5109-5124.

16. Bausch JN, Kramer FR, Miele EA, Dobkin C, and Mills DR (1983) Terminal adenylation in the synthesis of RNA by Qβ replicase. J Biol Chem 258, 1978-1984.

17. Nishihara T, Mills DR, and Kramer FR (1983) Localization of the Qβ replicase recognition site in MDV-1 RNA. J Biochem 93, 669-674.

18. LaFlamme SE, Kramer FR, and Mills DR (1986) Comparison of pausing during transcription and replication. Nucleic Acids Res 13, 8425-8440.

19. Priano C, Kramer FR, and Mills DR (1987) Evolution of RNA coliphages: the role of secondary structures during RNA replication. Cold Spring Harbor Symp Quant Biol 52, 321-330.

Replicatable recombinant RNA

20. Miele EA, Mills DR, and Kramer FR (1983) Autocatalytic replication of a recombinant RNA. J Mol Biol 171, 281-295.

21. Kramer FR, Miele EA, and Mills DR (1984) Recombinant RNA. In "The World Biotech Report 1984," Online Publications, Pinnar, United Kingdom, 347-356.

Gene detection utilizing recombinant RNAs

22. Chu BC, Kramer FR, and Orgel LE (1986) Synthesis of an amplifiable reporter RNA for bioassays. Nucleic Acids Res 14, 5591-5603.

23. Lizardi PM, Guerra CE, Lomeli H, Tussie-Luna I, and Kramer FR (1988) Exponential amplification of recombinant RNA hybridization probes. Biotechnology 6, 1197-1202.

24. Lomeli H, Tyagi S, Pritchard CG, Lizardi PM, and Kramer FR (1989) Quantitative assays based on the use of replicatable hybridization probes. Clin Chem 35, 1826-1831.

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26. Kramer FR, Lizardi PM, and Tyagi S (1992) Qβ amplification assays. Clin Chem 38, 456-457.

27. Blok HJ and Kramer FR (1997) Amplifiable hybridization probes containing a molecular switch. Mol Cell Probes 11, 187-194.

Coupled replication-translation

28. Wu Y, Zhang DY, and Kramer FR (1992) Amplifiable messenger RNA. Proc Natl Acad Sci USA 89, 11769-11773.

29. Ryabova L, Volianik E, Kurnasov O, Spirin A, Wu Y, and Kramer FR (1994) Coupled replication-translation of amplifiable messenger RNA: a cell-free protein synthesis system that mimics viral infection. J Biol Chem 269, 1501-1505.

Oligonucleotide arrays

30. Chetverin AB and Kramer FR (1993) Sequencing pools of nucleic acids on oligonucleotide arrays. Biosystems 30, 215-231.

31. Chetverin AB and Kramer FR (1994) Oligonucleotide arrays: new concepts and possibilities. Biotechnology 12, 1093-1099.

Binary hybridization probes

32. Tyagi S, Landegren U, Tazi M, Lizardi PM, and Kramer FR (1996) Extremely sensitive, background-free gene detection using binary probes and Qβ replicase. Proc Natl Acad Sci USA 93, 5395-5400.

33. Hsuih TCH, Park YN, Zaretsky C, Wu F, Tyagi S, Kramer FR, Sperling R, and Zhang DY (1996) Novel, ligation-dependent PCR assay for detection of hepatitis C virus in serum. J Clin Microbiol 34, 501-507.

Molecular beacons

34. Tyagi S and Kramer FR (1996) Molecular beacons: probes that fluoresce upon hybridization. Nature Biotechnol 14, 303-308.

35. Tyagi S, Bratu DP, and Kramer FR (1998) Multicolor molecular beacons for allele discrimination. Nature Biotechnol 16, 49-53.

36. Kostrikis LG, Tyagi S, Mhlanga MM, Ho DD, and Kramer FR (1998) Spectral genotyping of human alleles. Science 279, 1228-1229.

37. Marras SAE, Kramer FR, and Tyagi S (1999) Multiplex detection of single-nucleotide variations using molecular beacons. Genetic Analysis 14, 151-156.

38. Bonnet G, Tyagi S, Libchaber A, and Kramer FR (1999) Thermodynamic basis of the enhanced specificity of structured DNA probes. Proc Natl Acad Sci USA 96, 6171-6176.

39. Vet JAM, Majithia AR, Marras SAE, Tyagi S, Dube S, Poiesz BJ, and Kramer FR (1999) Multiplex detection of four pathogenic retroviruses using molecular beacons. Proc Natl Acad Sci USA 96, 6394-6399.

40. Cayouette M, Sucharczuk A, Moores J, Tyagi S, and Kramer FR (1999) Using molecular beacons to monitor PCR product formation. Strategies 12, 85-92.

41. Tyagi S, Marras SAE, and Kramer FR (2000) Wavelength-shifting molecular beacons. Nature Biotechnol 18, 1191-1196.

42. Fung C, Tyagi S, Harris L, Weisberg S, Pinter A, and Kramer FR (2001) Genetic screening using molecular beacons. Clin Chem 47, in preparation.

Molecular beacon applications

43. Gao W, Tyagi S, Kramer FR, and Goldman E (1997) Messenger RNA release from ribosomes during 5'-translational blockage by consecutive low-usage arginine but not leucine codons in *Escherichia coli*. Mol Microbiol 25, 707-716.

44. Leone G, van Schijndel H, van Gemen B, Kramer FR, and Schoen CD (1998) Molecular beacon probes combined with amplification by NASBA enable homogeneous, real-time detection of RNA. Nucleic Acids Res 26, 2150-2155.

45. Xiao G, Chicas A, Olivier M, Taya Y, Tyagi S, Kramer FR, and Bargonetti J (2000) A DNA damage signal is required for p53 to activate gadd45. Cancer Res 60, 1711-1719.

46. Dracheva S, Marras SAE, Elhakem SL, Kramer FR, Davis KL, and Haroutunian V (2001) NMDA receptor expression in DLPFC of schizophrenics. Amer J Psychiat 158, in press.

Mycobacterium tuberculosis

47. Piatek AS, Tyagi S, Pol AC, Telenti A, Miller LP, Kramer FR, and Alland D (1998) Molecular beacon sequence analysis for detecting drug resistance in *Mycobacterium tuberculosis*. Nature Biotechnol 16, 359-363.

48. Manganelli R, Dubnau E, Tyagi S, Kramer FR, and Smith I (1999) Differential expression of ten sigma factor genes in *Mycobacterium tuberculosis*. Mol Microbiol 31, 715-724.

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50. Piatek AS, Telenti A, Murray MR, El-Hajj H, Jacobs WR Jr, Kramer FR, and Alland D (2000) Genotypic analysis of *Mycobacterium tuberculosis* in two distinct populations using molecular beacons: implications for rapid susceptibility testing. Antimicrob Agents Chemother 44, 103-110.

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Reviews

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56. Lizardi PM and Kramer FR (1991) Exponential amplification of nucleic acids: new diagnostics using DNA polymerases and RNA replicases. Trends Biotechnol 9, 53-58.

57. Tyagi S, Marras SAE, Vet JAM, and Kramer FR (2000) Molecular beacons: hybridization probes for the detection of nucleic acids in homogeneous solutions. In "Nonradioactive Analysis of Biomolecules," Kessler C, ed, Springer-Verlag, Berlin, Germany , 606-616.

58. Marras SAE, Kramer FR, and Tyagi S (2001) Genotyping single nucleotide polymorphisms with molecular beacons. In "Single Nucleotide Polymorphisms: Methods and Protocols," Kwok PY, ed, Humana Press, Totowa, New Jersey, in press.

Current Research Support

1. National Institutes of Health Grant RO1 HL-43521-10
   Molecular beacons for retroviral diagnostics
   June 1, 2000 to May 31, 2005
   Fred Russell Kramer, Principal Investigator
   $562,448 this year ($2,949,532 total award)

2. National Institutes of Health Grant RO1 ES-10536-02
   Detecting mRNAs in living cells with molecular beacons
   October 1, 1999 to September 30, 2002
   Sanjay Tyagi, Principal Investigator
   $664,784 this year ($1,594,450 total award)

3. Hamilton Thorne Research Grant
   Genetic screening with molecular beacons
   January 1, 2000 to December 31, 2001
   Fred Russell Kramer and Sanjay Tyagi, Co-Principal Investigators
   $120,000 per year ($240,000 total award)

4. Ortho-Clinical Diagnostics Research Grant
   Detection of rare *ras* mutations using allele-discriminating primers
   January 1, 2001 to October 31, 2002
   Fred Russell Kramer, Principal Investigator
   $140,000 for 2001 ($260,000 total award)

5. National Institutes of Health Grant RO1 HL-68513-01
   Mycobacterium tuberculosis and host gene expression during infection
   September 1, 2001 to August 31, 2006
   Issar Smith (Public Health Research Institute), Principal Investigator
   Sanjay Tyagi, Co-Investigator
   $125,527 for the first year ($622,630 total requested for our laboratory)

6. The Public Health Research Institute
   Laboratory share of royalties and fees received for licensed patents (ongoing income)
   Fred Russell Kramer and Sanjay Tyagi
   $193,072 during 2000 ($225,000 estimated for 2001)

Patents and Patent Applications

Gene detection utilizing recombinant RNAs

1. Kramer FR, Miele EA, and Mills DR. US Patents 4,786,600 (November 22, 1988), 5,620,870 (April 15, 1997), and 5,871,976 (February 16, 1999). Autocatalytic replication of recombinant RNA. Conceived at Columbia University. Licensed to Gene-Trak Systems.

2. Chu B, Kramer FR, Lizardi P, and Orgel LE. US Patents 4,957,858 (September 18, 1990) and 5,364,760 (November 15, 1994), and European Patent 0266399 (May 18, 1994). Replicative RNA reporter systems. Conceived at Columbia University and the Salk Institute for Biological Studies. Licensed to Gene-Trak Systems.

3. Kramer FR and Lizardi PM. US Patent 5,112,734 (May 12, 1992) and European Patent 0473693 (April 12, 1995). Target-dependent synthesis of an artificial gene for the synthesis of a replicative RNA. Conceived for Gene-Trak Systems.

4. Axelrod VD, Kramer FR, Lizardi PM, and Mills, DR. US Patents 5,356,774 (October 18, 1994) and 5,620,851 (April 15, 1997), and European Patent 0386228 (August 26, 1996). Replicative RNA-based amplification/detection systems. Conceived at Columbia University. Licensed to Gene-Trak Systems.

5. Kramer FR and Lizardi PM. European Patent 0346594 (May 31, 1995). Replicatable hybridizable recombinant RNA probes and methods of using same. Conceived at Columbia University. Licensed to Gene-Trak Systems.

6. Kramer FR and Lizardi PM. US Patent 5,503,979 (April 2, 1996) and US Divisional Patent Application 08/484,992. Method of using replicatable hybridizable recombinant RNA probes. Conceived at Columbia University. Licensed to Gene-Trak Systems.

Target-dependent molecular switches

7. Lizardi PM, Kramer FR, Tyagi S, Guerra CE, and Lomeli-Buyoli HM. US Patent 5,118,801 (June 2, 1992). Nucleic acid process containing an improved molecular switch. Conceived at PHRI. Licensed to 39 companies.

8. Lizardi PM, Kramer FR, Tyagi S, Guerra CE, Lomeli-Buyoli HM, Chu BC, Joyce GF, and Orgel LE. US Patent 5,312,728 (May 17, 1994) and European Patent 0436644 (April 17, 1996). Assays and kits incorporating nucleic acid probes containing an improved molecular switch. Conceived at PHRI and the Salk Institute for Biological Studies. Licensed to 39 companies.

Coupled replication-translation

9. Wu Y, Ryabova LA, Kurnasov OV, Morosov IY, Ugarov VI, Volianik EV, Chetverin AB, Zhang D, Kramer FR, and Spirin AS. US Patent 5,556,769 (September 17, 1996). Coupled replication-translation methods and kits for protein synthesis. Conceived at PHRI.

10. Kramer FR, Miele EA, and Mills DR. US Patent 5,602,001 (February 11, 1997). Cell-free method for synthesizing a protein. Conceived at Columbia University.

Selection of improved ribozymes *in vivo*

11. Kramer FR, Dubnau D, Drlica KA, and Pinter A. US Patent 5,616,459 (April 1, 1997) and European Patent 0600877 (January 26, 2000). Selection of ribozymes that efficiently cleave target RNA. Conceived at PHRI.

Oligonucleotide arrays

12. Chetverin AB and Kramer FR. US Patent 6,103,463 (August 15, 2000). Method of sorting a mixture of nucleic acid strands on a binary array. Conceived at PHRI. Licensed to Affymetrix.

13. Chetverin AB and Kramer FR. US Divisional Patent Applications 08/473,010 and 09/164,249 (both which have been allowed). Novel oligonucleotide arrays and their use for sorting, isolating, sequencing, and manipulating nucleic acids. Conceived at PHRI. Licensed to Affymetrix.

Binary hybridization probes

14. Lizardi PM, Tyagi S, Landegren UD, Kramer FR, and Szostak JW. US Patent 5,652,107 (July 29, 1997). Diagnostic assays and kits for RNA using RNA binary probes and a ribozyme ligase. Conceived at PHRI and the Massachusetts General Hospital.

15. Tyagi S, Kramer FR, Lizardi PM, Landegren UD, and Blok HJ. US Patent 5,759,773 (June 2, 1998). Sensitive nucleic acid sandwich hybridization assay. Conceived at PHRI. Licensed to Vysis.

16. Tyagi S. US Patent 5,807,674 (September 15, 1998). Diagnostic assays and kits for RNA using RNA binary probes and a protein that is an RNA-directed RNA ligase. Conceived at PHRI. Licensed to Vysis.

Molecular beacons

17. Tyagi S, Kramer FR, and Lizardi PM. US patents 5,925,517 (July 20, 1999) and 6,103,476 (August 15, 2000). Detectably labeled dual conformation oligonucleotide probes, assays and kits. Conceived at PHRI. Licensed to 38 companies.

18. Tyagi S, Kramer FR, and Lizardi PM. European Patent Application 95904104.7. Hybridization probes for nucleic acid detection, universal stems, methods and kits. Conceived at PHRI. Licensed to 38 companies.

19. Tyagi S and Kramer FR. US Patent 6,150,097 (November 21, 2000). Nucleic acid detection probes having non-FRET fluorescence quenching and kits and assays including such probes. Conceived at PHRI. Licensed to 38 companies.

20. Kramer FR, Tyagi S, Alland D, Vet J, and Piatek A. International Patent Application PCT/US98/19182. Non-competitive co-amplification methods. Conceived at PHRI. Licensed to 38 companies.

21. Tyagi S, Kramer FR, and Marras SAE. US Patent 6,037,130 (March 14, 2000). Wavelength-shifting probes and primers and their use in assays and kits. Conceived at PHRI. Licensed to 38 companies.

22. Tyagi S, Kramer FR, and Alland D. International Patent Application PCT/US00/28515. Assays for short sequence variants. Conceived at PHRI.

23. Tyagi S and Kramer FR. Application in preparation. Molecular beacon pairs that interact by FRET to lower fluorescence background in living cells. Conceived at PHRI.

Allele-discriminating primers

24. Tyagi S, Kramer FR, and Vartikian R. US Patent 6,277,607 (August 21, 2001). High specificity primers, amplification methods and kits. Conceived at PHRI. Licensed to Ortho-Clinical Diagnostics.

Allele-discriminating antisense therapeutics

25. Tyagi S and Kramer FR. International Patent Application PCT/US00/14133. High specificity hairpin antisense oligonucleotides. Conceived at PHRI.

Oligonucleotide-facilitated coalescence of cells and liposomes

26. Tyagi S, Kramer FR, and Alsmadi OA. US Provisional Patent Application 60/239,698. Oligonucleotide-facilitated coalescence. Conceived at PHRI.